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Cocoa and Coffee Pricing Policies in Côte d'Ivoire

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Facing increasingly tough international competition in coffee and cocoa markets, Côte d'Ivoire can increase export revenues from the two commodities 8 percent in 1995 and about 12 percent in 2000 by increasing coffee production and cutting back on the expansion in cocoa production.

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Coffee and cocoa are Côte d'Ivoire's two most important commodity exports, accounting for about 50 percent of total exports. In the 1970s, Côte d'Ivoire capitalized on high world prices and a drop in production by other competitors to increase revenues from these crops, but in the mid-1980s the situation changed. Falling world prices and an appreciating currency cut into sales of Ivorian coffeee and cocoa at the same time that international supplies mounted. Brazilian coffee growers increased production after the previous year's drought, and production of cocoa rose in Ghana, Malaysia, and Indonesia. As several major producers backed up their export efforts with aggressive exchange rate policies, Côte d'Ivoire's exporters lost their competitive position.

To offset the slump in revenues, the government will have to reverse this decline in competitiveness. A study of the markets for both these commodities under different pricing and subsidy policies confirms that coffee production should be increased, even at the cost of some reduction in the output of cocoa. This will avoid large government subsidies to cocoa growers and will increase future exports of both products.

One way to do this is to devalue by 10 to 15 percent. Alternatively, the government could reduce cocoa producer prices and increase coffee producer prices. Although either of these policies would overcome short-term problems, a more fundamental change should be considered. Under current market conditions, government-established producer prices are no match for rapidly changing world markets and exchange rates. Unless Côte d'Ivoire adopts a flexible pricing policy, the country may face continuing problems in international competitiveness.

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I. INTRODUCTION

6. Cocoa and coffee are the two most important export commodities of Côte d'Ivoire. Together they accounted for about 50% of total exports in recent years. Moreover, the two crops constitute up to 40% of agricultural GNP and employment for over one-half of Ivorian farmers. The contribution to the Ivorian economy of the two commodities was especially significant during the 1970s when world prices were very high and when Ivorian cocoa production and export quantities increased sharply. However, the situation changed rather suddenly in the mid-1980s when world prices of coffee and cocoa weakened and as a sharp appreciation of the CFAF vis-a-vis the US dollar occurred.

7. This decline in world prices and the substantial appreciation of the CFAF meant sharp reductions in government revenues and some decline in real producer prices of these two commodities. These changes have occurred at a time when other major coffee and cocoa producing countries were adopting aggressive exchange rate policies. As a result Côte d'Ivoire has become relatively less competitive internationally when it needed to reverse its recent decline in coffee production.

8. The need to increase coffee production relative to cocoa is evident from the fact that the marginal export revenue of cocoa is only about US$1.10/kg while that of coffee is about US$2.20/kg. The marginal revenue of cocoa is low because Côte d'Ivoire's present world market share is very large,

to the extent that an increase in its exports would affect world cocoa prices adversely. Another reason for increasing coffee production is the possibility that Côte d'Ivoire would not be able to fill its International Coffee Agreement (ICA) quota, which might well lead to a reduction in its quotas. Experience has shown recovery of quota shares has been difficult.

9. All the factors mentioned above point to a changed situation facing Côte d'Ivoire. Consequently, its current policies toward the two commodities need examination and new policies require consideration.

10. This paper describes econometric models built to make projections of the coffee and cocoa sectors and reports the results of simulations of these models to evaluate changes in pricing and other policies. Descriptions of recent trends in the sectors and of policies adopted towards them are followed by quantitative analyses of the coffee and cocoa supply response in Côte d'Ivoire. The supply analysis constitutes the core of the models. Because almost all coffee and cocoa are exported, some description of the prospects for world markets is given. All these analyses are incorporated in the models and results of simulations of the models are discussed.

II. RECENT TRENDS IN IVORIAN COFFEE AND COCOA SECTORS

11. As shown in Tables 1 and 2 coffee and cocoa production trends have differed significantly since the early 1960s. Coffee production increased by about 2.8% p.a. during the 1960s, stagnated in the 1970s and has shown some decline since 1980. Cocoa production, on the other hand, has increased very strongly since the early 1960s--at an average rate of 7.5% p.a.

12. Two factors are responsible for the relatively high production growth of cocoa compared with coffee--movements in relative prices and inter-regional migration. As shown in Tables 1 and 2, coffee producer prices in the 1960s and early 1970s were about 25% higher than those for cocoa. But from the late 1970s onwards, cocoa producer prices increased substantially relative to coffee prices. This change in relative prices, as the analysis in the section below shows, has had an important impact on new plantings of the two crops. Available data indicate that new plantings of cocoa have increased sharply compared with those for coffee since the mid-1970s.

13. The second factor contributing to large increases in cocoa production was the migration of Baules from the Central Region. In the early 1970s, as the Central Region became drier, many Baules who grew cocoa there started migrating to the Center West, West, and Southwest Regions. The construction of Kousso Dam in the early 1970s accelerated this migration. The government also aided the migration by facilitating the Baules' acquisition of land in

TABLE 1: KEY VARIABLES OF THE IVORIAN COFFEE SECTOR

CROP YEAR	PRODUCTION	EXPORTS	NOMINAL PRODUCER PRICE	REAL PRODUCER PRICE
	----------(000 MT)---------		(CFAF/kg)	(1985 CFAF/kg)
1961/62	96.6	159.5		
1962/63	188.4	157.3		
1963/64	256.8	214.1	85.0	467.5
1964/65	200.4	161.3	90.0	481.9
1965/66	260.4	176.5	75.0	385.4
1966/67	120.6	166.8	90.0	452.5
1967/68	282.6	198.9	90.0	429.1
1968/69	199.3	176.1	90.0	415.8
1969/70	264.6	187.9	95.0	399.7
1970/71	240.0	202.1	105.0	445.3
1971/72	272.4	227.9	105.0	443.8
1972/73	240.6	216.5	105.0	400.8
1973/74	262.2	268.0	120.0	389.3
1974/75	269.4	213.5	150.0	436.4
1975/76	316.2	332.3	150.0	389.3
1976/77	292.2	276.4	180.0	366.8
1977/78	187.2	229.1	250.0	450.8
1978/79	284.4	279.6	250.0	386.1
1979/80	238.2	196.6	283.0	381.7
1980/81	365.4	221.6	283.0	350.9
1981/82	249.6	295.6	283.0	326.7
1982/83	270.6	252.2	283.0	308.6
1983/84	85.2	255.8	330.0	344.7
1984/85	276.6	231.4	358.0	368.0
1985/86	280.2	257.3	377.0	377.0
1986/87	230.4	199.4	377.0	

Sources: Production and Exports From USDA, Foreign Agricultural Circular, Coffee, August 1987. Nominal and real producer prices from CDGT (Control et Direction des Grands Travaux). The deflator used is the CPI for Africans in Abidjan.

TABLE 2: KEY VARIABLES OF THE IVORIAN COCOA SECTOR

CROP YEAR	PRODUCTION	COCOA BEAN EXPORTS	PRODUCT EXPORTS	TOTAL BEAN EQUIVALENT EXPORTS	NOMINAL PRODUCER PRICE	REAL PRODUCER PRICE
	(000'MT)				(CFAF/kg)	(1985 CFAF/kg)
1961/62	62.0					
1962/63	103.0					
1963/64	99.0				70.0	385.0
1964/65	148.0		0.7		70.0	374.8
1965/66	113.0	135.0	11.6	146.6	55.0	282.7
1966/67	150.0	95.0	18.3	113.3	70.0	351.9
1967/68	147.0	128.0	23.7	151.7	70.0	333.9
1968/69	145.0	115.0	30.2	145.2	70.0	323.4
1969/70	181.0	114.0	28.9	142.9	80.0	336.6
1970/71	180.0	145.0	36.6	181.6	85.0	360.5
1971/72	226.0	143.0	34.5	177.5	85.0	359.3
1972/73	181.0	188.0	38.7	226.7	85.0	324.5
1973/74	209.0	149.0	31.1	180.1	110.0	356.9
1974/75	242.0	173.0	35.1	208.1	175.0	509.2
1975/76	231.0	189.0	49.7	238.7	175.0	454.1
1976/77	230.0	178.0	48.4	226.4	180.0	366.8
1977/78	304.0	190.0	40.1	230.1	250.0	450.8
1978/79	318.0	239.0	56.2	295.2	250.0	386.1
1979/80	398.0	260.0	51.1	311.1	300.0	404.9
1980/81	417.0	321.0	51.2	372.2	300.0	372.0
1981/82	465.0	353.0	69.0	422.0	300.0	346.4
1982/83	360.0	393.0	62.3	455.3	300.0	327.1
1983/84	411.0	286.0	64.9	350.9	350.0	365.6
1984/85	565.0	449.0	78.5	527.5	375.0	385.5
1985/86	580.0	445.0	94.3	539.3	400.0	400.0
1986/87					400.0	

Sources: Production data from Gill and Duffus. Nominal and real prices from CDGT (the deflator used is the CPI for Africans in Abidjan). Bean and product exports from FAO.

the western regions. As Baules were traditionally cocoa growers, they spread cocoa planting techniques to farmers in the western regions. 1/

14. Export trends of the two commodities basically reflect the production trends. Export values, however, have fluctuated with world prices. World coffee prices were high in the second half of the 1970s, due mainly to the reduction in Brazil's production following a severe frost in 1975. But Brazil's production recovered by the early 1980s and world coffee prices declined. The International Coffee Agreement has succeeded in keeping nominal US$ prices from declining since 1981; they have, however, continued to decline in real terms--except for a short period in 1986 following a drought in Brazil.

15. World cocoa prices were high during most of the 1970s largely because production in Ghana and Nigeria declined. But since the early 1980s production in Ghana has recovered and production in Malaysia and Côte d'Ivoire has increased, putting nominal and real world cocoa prices under downward pressure.

16. The sharp decline in government revenue from the two commodities is an important recent development. This has been most strongly felt in 1987 as world prices of coffee and cocoa fell and as the CFAF appreciated sharply against the US dollar. The problem is especially serious for the cocoa

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1/ Coffee and cocoa production practices by the various tribes have been extensively studied in the Center West Region Project.

sector. Rather than being a source of significant government revenue, it is estimated that the cocoa sector will receive direct government payments of about CFAF20/kg in 1987/88 1/ (See table 4).

17. The government recognizes the relative weakness of the coffee sector. To strengthen the coffee sector and reduce cocoa production growth, in 1979 the government, through SATMACI (Societe d'Assistance Technique et de la Moderni ation de Agriculture en Côte d'Ivoire), started a progr .o encourage stumping of old coffee trees and in 1984 halted a program designed to encourage new plantings of cocoa. A program to encourage replanting of coffee trees is under consideration.

1/ In this paper crop years such as "1985/86" will be referred to as "1985" unless specified otherwise.

III. MAIN GOVERNMENT POLICY INSTRUMENTS IN THE COFFEE AND COCOA SECTORS

18. There are basically two instruments used by the government to influence behavior in the coffee and cocoa sectors--setting of producer prices and subsidies. Government policies in these two areas have had important effects and thus they will be examined here in some detail.

A. Producer Prices

19. In September of each year, just before the harvesting season, the government announces producer prices for coffee and cocoa. The producer prices appear to be decided irrespective of the level of world prices. They are determined by a Presidential decree to "reflect production cost" and "equal renumeration for all crops". Under this policy the ratio of official producer prices for coffee and cocoa has been constant since the 1976/77 season. However, in the 1979/80 season coffee began to be purchased as cherries 1/ rather than as green beans; therefore, some decline in coffee producer prices relative to cocoa occurred in that season.

20. The government not only determines producer prices but also domestic and external marketing and transportation costs. Each year the CSSPPA (Caisse de Stabilization et de Soutien des Prix des Produits Agricoles) publishes

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1/ Outer skin, pulp and silverskin need to be removed to convert a cherry to a green bean.

"Differentiels" for coffee and cocoa which specify in detail what private traders can charge the CSSPPA as domestic and external marketing and transportation costs. Export tax ("Droit Unique de Sortie" for cocoa and "Douane" for coffee) is included as an item in the "Differentiel" tables. Surpluses or losses arising from the differences between the actual world prices and the f.o.b. or c.i.f. prices given in the "Differentiel" are retained by the CSSPPA.

21. The unchanging coffee and cocoa price relationship has resulted in a large increase in cocoa production and some decline in coffee production in the last 10 years. Past production trends and production cost analysis strongly suggest that the present pricing policy does not "reflect production costs" and "equal renumeration for all crops" for the two crops. The government is aware of the production trends of recent years but has found it difficult to change the price relationship. Instead, it has been inclined to adopt subsidy policies in favor of coffee.

22. The existing pricing policy created another major problem in the 1987 season. As tables 3 and 4 show, the CSSPPA is expected to incur a large deficit in the current season due to the decline in world cocoa prices and the sharp appreciation of the CFAF. Coffee is expected to show some surplus, thanks to the recent recovery in world coffee prices.

TABLE 3: ESTIMATED BALANCE OF CSSPPA AND GOVERNMENT FOR COFFEE; 1979/80-1987/88

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
	(CFAF/KG)								
PRODUCER PRICE (cherry)	150.0	150.0	150.0	150.0	175.0	190.0	200.0	200.0	200.0
LOCAL COLLECTION, STORAGE & HANDLING COST	10.6	11.7	13.5	16.3	16.1	16.6	17.8	14.8	14.8
PRICE (GREEN EQUIVALENT)	303.0	305.1	308.5	313.8	360.6	389.8	410.9	405.4	405.4
MARKETING, PROCESSING, TRANSPORTATION & STORAGE COST	58.0	64.1	70.6	74.2	79.7	83.7	88.3	73.5	73.5
EXPORT TAX	57.5	57.5	57.5	57.5	80.5	80.5	80.5	100.5	100.5
EXPORTER'S PROFIT	2.4	2.6	2.7	2.7	2.9	2.9	3.2	3.0	3.0
PORT HANDLING COST	2.3	2.7	2.7	3.3	3.3	3.3	3.7	3.8	3.8
F.O.B. VALUE	423.2	432.0	442.0	451.5	527.0	560.2	586.6	586.1	586.1
FREIGHT & INSURANCE	56.0	57.0	58.0	58.0	60.0	69.9	63.5	63.5	63.5
C.I.F. VALUE	479.2	489.0	500.0	509.5	587.0	630.1	650.1	649.6	649.6
COST HORS BAREME /a	50.0	50.0	50.0	50.0	55.1	68.0	58.2	58.7	58.7
TOTAL COST TO CSSPPA	529.2	539.0	550.0	559.5	642.1	698.1	708.3	708.3	708.3
ACTUAL C.I.F. VALUE	834.9	678.1	693.0	735.2	985.5	1,105.3	1,101.4	743.6	710.5 /b
BALANCE OF CSSPPA	305.7	139.1	143.0	175.7	343.4	407.2	393.1	35.3	2.2
BALANCE OF GOVERNMENT	363.2	196.6	200.5	233.2	423.9	487.7	473.6	135.8	102.7

/a Includes cost for storage, financing, and payments to processors for capacity underutilization.
/b Estimated by International Commodity Markets Division.

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
	(CFAF/KG)								
PRODUCER PRICE	300.0	300.0	300.0	300.0	350.0	375.0	400.0	400.0	400.0
LOCAL COLLECTION (cherry) STORAGE & HANDLING COST	15.4	17.0	19.2	20.9	23.2	24.1	25.1	25.1	25.0
MARKETING, PROCESSING TRANSPORTATION & STORAGE COST	30.6	33.0	37.0	40.8	44.5	44.7	51.2	51.7	53.1
EXPORT TAX	50.6	50.6	50.6	50.6	80.5	80.5	80.5	100.5	100.5
EXPORTER'S PROFIT	2.1	2.3	2.4	3.3	3.3	3.3	2.9	2.5	3.3
PORT HANDLING COST	2.3	2.7	2.7	3.3	3.3	3.3	3.5	3.8	3.5
F.O.B. VALUE	401.0	405.6	411.9	418.9	504.8	530.9	563.2	583.6	584.4
FREIGHT & INSURANCE	44.0	49.0	51.0	51.0	58.1	66.8	76.0	73.7	73.7
C.I.F. VALUE	445.0	454.6	462.9	469.9	562.9	597.7	639.2	657.3	659.1
COST HORS BAREME /a	35.0	35.0	35.0	35.0	39.9	42.7	33.3	33.3	32.3
TOTAL COST TO CSSPPA	480.0	489.6	497.9	504.9	602.8	640.4	672.5	690.6	691.4
ACTUAL C.I.F. VALUE	627.6	510.0	595.0	651.4	876.5	992.9	864.3	705.9	571.5 /b
BALANCE OF CSSPPA	147.6	20.4	97.1	146.5	273.7	352.5	191.8	15.3	-119.9
BALANCE OF GOVERNMENT	198.2	71.0	147.7	197.1	354.2	433.0	272.3	115.8	-19.4

/a The export tax has been raised from 23% of the "valeur mercuriale" for the crops 1980/81-1985/86 to 25.125% for the 1986/87 crop.

/b Estimated by International Commodity Markets Division.

Source: CSSPPA.

23. An obvious way to reduce the CSSPPA deficit on cocoa is to reduce cocoa producer prices. An argument against this policy is that such action would defeat the purpose of the CSSPPA price stabilization operation. The CSSPPA should, it could be argued, offset the deficits arising from an unfavorable world market situation by using the large surplus it has accumulated in recent years when the world market was much more favorable.

B. Subsidy Policies

24. In Côte d'Ivoire extension services and subsidy programs for the two sectors are carried out by SATMACI and agronomic research is done by IRCC (Coffee and Cocoa Research Institute). Communications are well established between the two institutions and research results are passed from IRCC to SATMACI and, in turn, to growers.

25. A subsidy program for cocoa was in effect between 1971 and 1983. During this period, SATMACI distributed 1,500 plastic bags (to hold seedlings) and 50 hybrid cocoa seeds per hectare, as well as subsidized fertilizer and insecticides. Subsidized credits were also given to growers to purchase power insecticide sprayers (atomiseur) and manual insecticide and fungicide sprayers (pulverisateur). This program was stopped after 1983 as the government considered that cocoa production had reached its target.

26. A subsidy program for coffee also started in 1971. It consisted of free distribution of 1,500 plastic bags (sachets) and 1,750 improved variety seedlings per hectare. This program continues, although there was some

reduction during the period 1983-1986 when the government feared a large accumulation of stocks due to the ICA quotas. During this period, several seedling nurseries were closed down. This move has caused some shortages of seedlings since 1983.

27. A subsidy program on stumping (recepage) began in 1979/80. Stumping is a coffee tree rejuvenation technique in which all or some of the large shoots are cut. Stumping usually reduces the yield of a tree for a year or two, but after the third year yield recovers to the level of young trees. In the first year, 20,000 CFAF/ha worth of materials (such as saws and fertilizer) and cash of 20,000 CFAF/ha are given to growers. In the second year, another 20,000 CFAF/ha in cash is given. "Objective" and actual stumped areas under the program since 1980/81 are given in Table 5. From 1980/81 to 1984/85 the actual stumped area fell well below the objectives of the program. In the last two years the area stumped has increased sharply. SATMACI extension officers consider that recent increases in the stumped area result from growers' appreciation of the beneficial effects of stumping.

28. The effect of stumping on yield is uncertain. Although in a controlled research station situation stumping will increase yield substantially, good husbandry, including weeding and fertilizer applications, is necessary for stumping to be effective. Under the extension program, subsidies are given for stumping but not to encourage better husbandry. Higher coffee producer prices may be necessary for this program to be more effective.

Table 5: PLANNED AND ACTUAL STUMPED HECTARAGE

(Hectares)

Years	Objective	Actual
1980/81	12,500	7,176
1981/82	13,000	7,133
1982/83	17,000	8,860
1983/84	20,000	4,881
1984/85	20,000	7,698
1985/86	17,200	12,135
1986/87	15,000	16,890

Source: SATMACI.

29. There is another important factor to be taken into account if the stumping subsidy program is to be used as one of the major policy instruments to increase coffee production. To be effective stumping must be carried out every 5 to 6 years. Thus, the stumping program will not contribute to net accumulated stumped area after 5 or 6 years if the annual stumping hectarage stays at the same level. To clarify this point, let's assume that the stumping program succeeds in making growers stump 15,000 ha a year. After five years, there will be total stumped area of 75,000 ha. But from the sixth year onward, the 15,000 ha which were stumped in the first year will be ready for stumping again. So in net terms, the program cannot increase the total stumped area after the fifth year unless the annual stumping rate is increased.

30. A subsidy program for uprooting old coffee trees and planting new ones is currently under consideration. Through this program an as yet

undetermined sum of cash will be paid to farmers who uproot old trees and plant new ones. This program will also increase coffee production using incentives other than producer prices. Evaluation of this program and the stumping program will be made in Section VI using the supply models.

31. This brief review of recent subsidy programs reveals a strenuous effort by the government in the last few years to encourage coffee production relative to cocoa production. These programs are being undertaken for two reasons; the political difficulty of changing the relationship between coffee and cocoa prices and the strains on the government budget.

IV. QUANTITATIVE ANALYSIS OF COFFEE AND COCOA SUPPLY IN CÔTE d'IVOIRE

32. In order to analyze coffee and cocoa supply response quantitatively, the vintage capital approach was used. 1/ The vintage capital approach requires annual data on new plantings, and the yield curve and the death rates of trees by age group. In addition, a distinction has to be made between high-yielding and traditional varieties. Assumptions made in constructing the vintage matrices are given in Annex B. As discussed there, the effects of bush fires in 1983 and the estimated effects of stumping are taken into account.

33. Data on new plantings, by year, are kept by the Ministry of Agriculture. However, these data cover only the area planted by the improved coffee seedlings and hybrid cocoa seeds distributed by SATMACI. The only source available for total annual coffee and cocoa new plantings is the agricultural surveys conducted by MINAGREF DSREA in 1974, 1979 and 1983. New planting areas estimated from the surveys are given in Table 6.

34. An obvious shortcoming of the new planting data given in Table 6 is that no data on total plantings after 1983 are available. This not only makes it difficult to evaluate recent new planting developments, but also excludes any possibility of evaluating the impact of cocoa subsidies in effect between

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1/ See for details Akiyama, T. and P. Trivedi, "A New Global Tea Model", World Bank Staff Commodity Working Paper No. 17, 1987.

TABLE 6: ANNUAL NEW PLANTINGS OF COFFEE AND COCOA, 1971-83

CROP YEAR	COFFEE			COCOA			COFFEE AND COCOA
	TOTAL	IMPROVED COFFEE	SHARE OF IMPROVED COFFEE	TOTAL	HYBRID	SHARE OF HYBRID	
	----------HA----------		--%--	----------HA----------		---%---	--000 HA--
1971	67,100.0	1,073.0	2.0	35,300.0	2,513.0	7.0	102.4
1972	44,100.0	2,656.0	6.0	55,600.0	6,583.0	12.0	99.7
1973	31,800.0	7,395.0	23.0	42,900.0	7,959.0	19.0	74.7
1974	40,400.0	7,315.0	18.0	57,400.0	10,226.0	18.0	97.8
1975	37,500.0	9,335.0	25.0	64,600.0	13,762.0	21.0	102.1
1976	37,900.0	9,027.0	24.0	51,700.0	16,129.0	31.0	89.6
1977	18,300.0	10,239.0	56.0	82,400.0	20,741.0	25.0	100.7
1978	27,400.0	10,736.0	39.0	65,700.0	22,207.0	34.0	93.1
1979	31,000.0	10,104.0	33.0	89,600.0	24,254.0	27.0	120.6
1980	23,000.0	9,956.0	43.0	73,000.0	23,243.0	32.0	96.0
1981	23,600.0	11,066.0	47.0	74,700.0	19,703.0	26.0	98.3
1982	18,000.0	8,073.0	45.0	63,200.0	6,744.0	11.0	81.2
1983	(15,000.0)	6,086.0	(41.0)	(50,000.0)	6,186.0	12.0	(65.0)
1984		4,474.0			3,351.0		
1985		5,745.0			7,823.0		
1986		2,539.0			13,033.0		
1987		6,285.0					
*TOTAL	415,100.0	103,061.0	25.0	806,100.0	180,250.0	22.0	1,221.2

* Total for 1971-83.

SOURCE: SATMACI and MINAGREF DSREA (Ministere de l'Agriculture et des Eaux et Forets, Direction des Statistiques et des Enquetes Agricoles).

1971 and 1983. The effects of subsidies on new cocoa plantings may not be significant, however; the subsidies were given only to those growers who received SATMACI extension services, which included planting hybrid seeds. As Table 6 shows, the share of growers who have planted hybrid varieties is relatively small.

35. Another possible problem with the data in Table 6 is with regard to the new planting data on coffee. Several SATMACI extension officers consulted consider the total annual plantings data to be overestimated, especially after 1978. They consider most of the coffee new plantings in recent years to be of the improved variety distributed by SATMACI. Unfortunately, unless another survey is conducted, verification of these claims is impossible.

36. Regression analysis was carried out to estimate the effects of producer prices on new plantings, under the assumption that new plantings of both coffee and cocoa are influenced by the producer prices of the two commodities. The regression analysis proved rather inconclusive because for much of the period for which data are available the ratio of coffee and cocoa producer prices was constant. However, several regression runs indicated that Ivorian farmers' coffee and cocoa new plantings are very sensitive to real prices. The best estimates for coffee new plantings are 4.0 for the own-price

elasticity and -1.5 for the cross-price elasticity. For cocoa they were 1.9 and -0.6. 1/

37. Construction of the vintage capital matrices provide potential production capacities. The estimated production capacity values can be regressed against actual production values, together with other relevant variables, to see if the data and assumptions used to calculate production capacity values are correct. The regression results show the coefficients relating production potential to actual production to be 1.02 and 0.99 for cocoa and coffee, respectively. These coefficients are statistically very significant. The results indicate that the calculated production potential of the two commodities follow actual production very closely, which suggests that the assumptions made in calculating production potential are not far from reality.

38. The statistical analysis did not show much significance on the short-term price elasticities. They are assumed here to be 0.22 for the own-price elasticities of both commodities 2/ and 0.08 for cocoa prices on coffee

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1/ The estimated cross-price elasticities are in accordance with the cross-price symmetry condition which, with a little modification, states that the ratio of two cross-price elasticities should be in reverse proportion to the ratio of the produced values of two commodities. (See p. 33, Hal R. Varian Microeconomic Analysis, W.W. Norton & Co. Inc., 1978.

2/ Although not significant statistically, coffee's estimated own-price elasticities ranged between 0.16 and 0.28.

production and 0.04 for coffee prices on cocoa production. 1/

39. As discussed by Akiyama and Trivedi, 2/ long-term price elasticities of supply change with time. Own- and cross-price elasticities of supply for coffee and cocoa are given in Table 7. These elasticities are derived from the model simulations.

Table 7: PRICE ELASTICITIES OF COCOA AND COFFEE SUPPLY

	Cocoa		Coffee	
	Own	Cross	Own	Cross
Short-Term (Immediate)	0.22	0.04	0.22	0.08
Medium-Term (5 years)	0.27	0.06	0.32	0.12
Long-Term (10 years)	0.60	0.17	1.10	0.40

Source: IECCM.

1/ Coffee's cross-price elasticity was estimated to be 0.08. Using the cross-price symmetry condition (described earlier) cocoa's cross-price elasticity is assumed to be 0.04.

2/ Ibid.

V. INTERNATIONAL ENVIRONMENT FACING COFFEE AND COCOA SECTORS

40. Because most of the coffee and cocoa produced in Côte d'Ivoire is exported, Ivorian policies must take into account the international markets for coffee and cocoa. Two topics are considered here--recent developments in the currencies of major coffee and cocoa producing countries and prospects for the world coffee and cocoa markets. These topics are discussed with specific reference to their interest for Côte d'Ivoire.

A. Recent Developments in the Currencies of Major Coffee and Cocoa Producing Countries

41. Prices of both coffee and cocoa declined sharply in 1987 compared with levels that prevailed in 1985 and 1986. Ceteris paribus, this decline should lead to lower producer prices in coffee and cocoa producing countries and, in turn, to reduced world production. However, such relationships will exist only when other variables such as exchange rates, export tax rates and productivity do not change. An important development among major coffee and cocoa producing countries in the last few years has been the variations in exchange rates.

42. The impact of exchange rate changes on supply competitiveness is well known; for example, there are several studies linking the decline of cocoa production in Ghana to its over-valued currency. The recent sharp appreciation of the CFAF vis-a-vis the US dollar would not have reduced

Ivorian relative competitiveness in producing coffee and cocoa if the currencies of other major producing countries had also appreciated. Table 8 shows real exchange rate movements in selected major coffee and cocoa producing countries. As the table shows, appreciation of the CFAF has been substantial in real terms--some 35% since 1982. However, the currencies of other major coffee and cocoa producing countries have not appreciated as much as the CFAF. In fact, Brazilian, Colombian, Indonesian and Ghanaian currencies have depreciated substantially vis-a-vis the US dollar in the last five years.

43. The relative movements of real exchange rates among major coffee and cocoa producing countries have important implications for world market prospects. In economic terms, real depreciation of these currencies translates to a significant shift of world supply curves to the right in the price-supply diagram. In other words, with such currency devaluation, world coffee and cocoa supplies can be increasing in spite of a decline in world prices expressed in US dollars. If these countries with depreciating currencies maintain their real exchange rates at current levels or continue to devalue, world coffee and cocoa prices are likely to stay at considerably lower levels in real terms than in the 1970s.

44. To avoid losing its competitiveness in the long run, a country in the position of Côte d'Ivoire can react to the situation by one or a combination of two measures--devaluation or productivity increases. However, devaluation alone cannot be thought of as an instrument which can be used indefinitely to maintain competitiveness. If devaluation is ruled out because of Côte

TABLE 8: REAL EXCHANGE RATE MOVEMENTS IN MAJOR COFFEE AND COCOA PRODUCING COUNTRIES a/
(1982 - 1987)

	1982	1983	1984	1985	1986	1987
BRAZIL						
Nominal exchange rate	0.18	0.58	1.85	6.20	13.63	32.29
Consumer price index b/	407.00	984.00	2,924.00	9,556.00	23,436.00	76,334.00
Real exchange rate	100.00	75.42	69.98	68.17	76.07	65.99
COLOMBIA						
Nominal exchange rate	64.08	78.85	100.82	142.13	194.26	237.18
Consumer price index	158.80	190.20	220.80	273.90	325.70	406.40
Real exchange rate	100.00	97.34	88.37	77.76	67.66	69.14
COSTA RICA						
Nominal exchange rate	37.41	41.09	44.53	50.45	55.99	61.26
Consumer price index	260.60	345.60	386.90	445.10	497.80	581.80
Real exchange rate	100.00	120.72	124.71	126.63	127.63	136.32
EL SALVADOR /c						
Nominal exchange rate	2.5	2.5	2.5	2.5	5.0	5.0
Consumer price index	128.30	145.30	162.10	198.20	261.60	330.00
Real exchange rate	100.00	113.25	126.34	154.48	101.95	128.60
GUATAMALA						
Nominal exchange rate	1.00	1.00	1.00	1.00	1.88	2.50
Consumer price index	111.80	116.80	120.80	143.40	196.40	220.10
Real exchange rate	100.00	104.47	108.05	128.26	93.69	78.75
INDONESIA						
Nominal exchange rate	661.40	909.30	1,025.90	1,110.60	1,282.60	1,642.09
Consumer price index	112.20	122.90	137.40	151.70	158.90	183.50
Real exchange rate	100.00	79.67	78.95	80.52	73.03	65.88
MALAYSIA						
Nominal exchange rate	2.34	2.32	2.34	2.48	2.58	2.52
Consumer price index	116.10	120.40	125.10	125.50	126.40	127.90
Real exchange rate	100.00	104.33	107.37	101.67	98.50	101.95
CAMEROON						
Nominal exchange rate	328.16	381.06	436.26	449.26	346.30	304.81
Consumer price index	125.40	146.30	162.90	165.00	173.02	183.03
Real exchange rate	100.00	100.61	97.70	96.25	128.80	139.30

TABLE 8: REAL EXCHANGE RATE MOVEMENTS IN MAJOR COFFEE AND COCOA PRODUCING COUNTRIES continued...
(1982 - 1987)

	1982	1983	1984	1985	1986	1987
COTE D'IVORE						
Nominal exchange rate	328.61	381.06	436.96	449.26	346.30	304.81
Consumer price index	116.80	123.70	129.00	131.40	140.10	147.05
Real exchange rate	100.00	91.33	83.06	82.29	113.82	134.74
GHANA						
Nominal exchange rate	2.75	3.45	35.34	54.05	89.29	133.33
Consumer price index	264.80	590.10	824.10	909.10	1,132.40	1,544.03
Real exchange rate	100.00	177.63	24.22	17.47	13.17	12.04
KENYA						
Nominal exchange rate	10.92	13.31	14.41	16.43	16.23	16.30
Consumer price index	134.70	150.20	165.40	187.00	194.40	202.00
Real exchange rate	100.00	91.49	93.04	92.28	97.14	100.48
NIGERIA						
Nominal exchange rate	0.67	0.72	0.76	0.89	1.35	3.93
Consumer price index	130.10	160.30	223.80	236.10	248.80	249.01
Real exchange rate	100.00	114.66	151.65	136.62	94.61	32.46
UGANDA						
Nominal exchange rate	94.05	153.86	359.70	672.02	1,400.00	4,284.10
Consumer price index	200.30	248.30	343.30	797.80	2,217.80	7,498.80
Real exchange rate	100.00	75.78	44.81	55.88	74.38	81.98

/a Formula used to calculate real exchange rate is:

$$REX_t = (NEX_{82}/NEX_t) * (CPI_t/CPI_{82})$$

Where: REX_t = Real Exchange Rate in year t
NEX_t = Nominal Exchange Rate in year t
NEX_{82} = Nominal Exchange Rate in 1982
CPI_t = Consumer Price Index in year t
CPI_{82} = Consumer Price Index in year 1982

/b CPI is with 1980 as 100 except for Uganda which is with April 1981 as 100.

Source: IMF, International Financial Statistics.

d'Ivoire's participation in the CFA zone, ongoing measures aimed at increasing productivity become indispensable for Côte d'Ivoire if it is to regain or even maintain its competitiveness.

B. World Market Prospects for Coffee

45. World market prospects for coffee depend to an extent on the fate of the International Coffee Agreement (ICA). The current ICA, with its export quota regime, is expected to be in force until September 1989. Although the quotas were lifted for about 20 months between February 1986 and September 1987, because of the boom in prices, the agreement's renegotiated quotas are likely to be effective throughout the remainder of the agreement. At present it is difficult to project whether a new agreement will come into force from October 1989. There are several issues which have arisen between producers and consumers which have remained unsettled for several years and which could lead to difficulties in the renegotiations.

46. Even if the ICA quota system continues, the price prospects for coffee are not bright because of slow demand growth and productivity growth. Because productivity growth is expected to be high in Brazil, Colombia and Indonesia, production growth in these countries should be sufficient to meet

small increases in global quotas, even at low real world prices. 1/ World net imports are expected to increase by only 1.0 to 1.5% p.a. between now and the year 2000. An important reason for this expected slow growth is the low population growth in the industrial countries where over 90% of world coffee is consumed. In real terms, coffee prices are expected to remain near the current historically low levels through 2000.

47. If the Coffee Agreement were suspended, world coffee prices over the next five years could be expected to average between 15 and 30% lower than would be the case in the presence of the Agreement and with quotas near present levels. If the current exchange rate relationships between coffee-producing countries continue, many other major coffee producing countries could absorb such a price decline and still produce at present levels, especially if they reduced their export tax on coffee. This option appears not to be available for Côte d'Ivoire. A 20% decline in prices, for example, would either force the government to subsidize the coffee sector or reduce producer prices. The first option cannot be employed for an extended period of time. The second option would reduce Ivorian coffee production. Thus, if the quota system were to be lifted, Côte d'Ivoire would face the high probability of a substantial reduction in its coffee export prices and quantitites for several years after the suspension of the quotas.

1/ If, on the other hand, demand were to increase at a high rate, the global quotas are also likely to be increased at a high rate. In this case real world prices would need to be raised to encourage larger world production, especially if there is no productivity increase.

48. If the export quota regime continues, Côte d'Ivoire should aim at producing about 300,000 tons of coffee for the next 5 to 10 years. This would enable it to fulfill its existing and prospective quotas, even allowing for years of bad crops when it would draw down its stocks. However, it should be noted that even if Côte d'Ivoire attains this level of production, real export revenue from coffee is likely to be lower than in the early 1980s because of the expected lower world real coffee prices.

C. World Market Prospects for Cocoa

49. Large plantings of cocoa were made in the late 1970s in response to the high world prices. These trees are now coming into full production. Real world cocoa prices have fallen to very low levels and are expected to be weak until the early 1990s. They should strengthen towards the late 1990s as production responds to the present low prices. Because Côte d'Ivoire is the largest producer, accounting for about 30% of world production in recent years, world cocoa prices depend critically on what happens there. (Côte d'Ivoire's share in world cocoa production is approximately the same as Brazil's share in world coffee production in recent years).

50. This large share creates a serious obstacle to Côte d'Ivoire increasing its export revenues from cocoa as it is not a "price-taker", i.e., ceteris paribus, a 1% increase in cocoa exports by Côte d'Ivoire leads to an export revenue increase of less than 1% because the world price falls. As shown in Annex A, we estimate that world cocoa prices decline by 0.41% if Côte d'Ivoire increases its exports by 1%. Thus, a 1% increase in cocoa exports

translates to a 0.59% increase in export revenues for Côte d'Ivoire. From the export revenue point of view, it is equivalent to the last 1% of export quantity earning only 59% of the world price.

51. The above calculation may be optimistic because it assumes no productivity increase or currency devaluation by other producing countries. In other words, if other major producing countries cope with lower US dollar cocoa prices by currency devaluation, productivity increases or reductions in export taxes, the last 1% of export quantity would earn an even smaller percentage of the world price than 59%. If there is no reduction in cocoa production in other countries, Ivorian marginal export revenue will be about zero, that is, export revenue would not increase through an export quantity increase. If cocoa investment is evaluated in these terms, alternative crops such as natural rubber or oil palm may become more attractive.

VI. SOME SIMULATION RESULTS FROM THE COFFEE AND COCOA MODELS

52. The supply models for coffee and cocoa can be used to simulate future production of the two commodities under various scenarios about pricing and subsidy policies. The results are presented in terms of export quantities and revenues and impact on government and CSSPPA revenues. All prices and revenues are in 1987 constant terms.

A. Base Case Projections

53. Before evaluating various policies using the model, base case projections are made. The assumptions made in the Base Runs are:

(a) Producer prices will be held at present levels in constant terms through 2000;

(b) C.i.f. unit export values will be the projections by the World Bank of the ICCO Indicator Price for cocoa and the ICO robusta coffee price. However, for cocoa, changes in Ivorian production is assumed to affect world prices in the way described in Annex A;

(c) Domestic marketing and transportation and overseas transportation costs are assumed to be at the same level in the future as those given in the "Differentials" for the 1987/88 season;

(d) The stumping subsidy program is assumed to continue at the rate of 13,000 ha per year;

(e) The exchange rate of CFAF vis-a-vis the US dollar is assumed to stay at the recent rate of 290 CFAF to one dollar;

(f) All coffee and cocoa produced is assumed to be exported.

(g) To account for diminishing land availability, the elasticity of response of new plantings to increases in prices is assumed to decline by 2% p.a. from 1988.

54. Simulation results for the Base Runs in terms of some key variables are given in Tables 9 and 10. Some important features of the results include:

(a) Huge CSSPPA and government deficits are projected to be incurred from cocoa while some surpluses are expected from coffee. The CSSPPA is likely to incur deficits from cocoa of about CFAF 100 billion every year from 1988 to 1998. Government deficits are likely to be between CFAF 20 and 55 billion annually between 1988 and 1996. The deficits are projected to decline in the late 1990s when world cocoa prices are expected to strengthen.

TABLE 9: RESULTS OF BASE RUNS FOR COCOA; 1988-2000

Year	Production	Cost to /a CSSPPA on c.i.f. Basis	World Price		Revenue From Export Tax	CSSPPA Balance	Net Government Balance	Export Revenue	
	-('000 T)-	--(CFAF/kg)--	(US$/kg)	(CFAF/kg)	(Billion CFAF)	(Billion CFAF)	(Billion CFAF)	(Million US$)	(Billion CFAF)
1988	651.00	691.40	180.00	521.00	65.41	-111.13	-45.72	1,003.19	290.93
1989	676.00	691.40	176.00	512.00	67.92	-121.42	-53.50	1,020.81	296.04
1990	701.00	691.40	179.00	519.00	70.43	-120.86	-50.43	1,075.96	312.03
1991	726.00	691.40	181.00	526.00	72.95	-120.02	-47.07	1,132.19	328.34
1992	749.00	691.40	184.00	534.00	75.24	-117.99	-42.75	1,187.78	344.46
1993	772.00	691.40	187.00	541.00	77.60	-115.90	-38.31	1,244.90	361.02
1994	793.00	691.40	189.00	550.00	79.71	-112.53	-32.83	1,301.25	377.36
1995	806.00	691.40	193.00	560.00	80.99	-105.60	-24.61	1,352.44	392.21
1996	820.00	691.40	197.00	571.00	82.42	-98.94	-16.52	1,405.67	407.64
1997	832.00	691.40	201.00	583.00	83.59	-90.54	-6.94	1,459.48	423.25
1998	845.00	691.40	205.00	594.00	84.88	-82.29	2.59	1,515.15	439.39
1999	852.00	691.40	209.00	607.00	85.66	-71.89	13.77	1,567.60	454.60
2000	861.00	691.40	214.00	620.00	86.51	-61.50	25.01	1,621.33	470.19

/a Includes export tax of CFAF 100.5/kg and non-marketing and transportation cost of CFAF 190.9/kg.

Source: IECCM.

TABLE 10: RESULTS OF BASE RUNS FOR COFFEE; 1988-2000

Year	Production	Cost to /a CSSPPA on c.i.f. Basis	World Price		Revenue From Export Tax	CSSPPA Balance	Net Government /b Balance	Export Revenue	
	-('000 T)-	--(CFAF/kg)--	(US$/kg)	(CFAF/kg)	(Billion CFAF)	(Billion CFAF)	(Billion CFAF)	(Million US$)	(Billion CFAF)
Coffee									
1988	239.00	707.90	240.00	696.00	23.79	-2.82	19.89	516.31	149.73
1989	237.00	707.90	250.00	725.00	23.56	4.01	26.49	534.76	155.08
1990	234.00	707.90	254.00	736.60	23.26	6.64	28.83	537.27	155.81
1991	220.00	707.90	258.00	748.20	21.91	8.79	29.62	514.78	149.29
1992	211.00	707.90	262.00	759.80	20.98	10.83	30.73	501.13	145.33
1993	204.00	707.90	266.00	771.40	20.25	12.79	31.96	491.83	142.63
1994	197.00	707.90	270.00	783.00	19.51	14.58	33.02	481.75	139.71
1995	190.00	707.90	271.00	785.90	18.89	14.66	32.46	468.11	135.75
1996	186.00	707.90	272.00	788.88	18.41	14.82	32.16	458.24	132.89
1997	182.00	707.90	273.00	791.70	17.99	15.00	31.92	449.58	130.38
1998	177.00	707.90	274.00	794.60	17.58	15.17	31.67	441.01	127.89
1999	173.00	707.90	275.00	797.50	17.10	15.24	31.26	430.53	124.86
2000	167.00	707.90	275.00	797.50	16.53	14.74	30.19	416.39	120.75

/a Includes export tax of CFAF 100.5/kg and non-marketing and transportation cost of CFAF 230.4/kg.
/b Includes CFAF 1.08 billion for the stumping program.

Source: IECON.

(b) Cocoa production is expected to continue to increase at a rapid rate to reach 806,000 tons by 1995 and 861,000 tons by 2000. Coffee production is projected to decline to 190,000 tons by 1995 and to 167,000 tons by 2000.

(c) Real cocoa export revenue is projected to increase from US$1,003 million in 1988 to US$1,352 million in 1995 and to US$1,621 million in 2000. Real coffee export revenue is expected to decline from US$516 million in 1988 to US$468 million in 1995 and to US$416 million in 2000.

55. The base runs show that if the present pricing policy and exchange rate level are maintained, the cocoa sector will become a serious financial problem for Côte d'Ivoire. This can be easily seen from Table 11 where the details are presented for 1988.

Table 11: PROJECTED BALANCE SHEET FOR COCOA FOR 1988

World c.i.f. Price (US$/kg)	1.80
Exchange Rate (CFAF/US$)	290.00
World c.i.f. Price (CFAF/kg)	522.00
Producer Price (CFAF/kg)	400.00
Domestic Marketing and Transportation Costs (CFAF/kg)	117.20
Freight and Insurance (CFAF/kg)	73.70
Export Tax (CFAF/kg)	100.50
Cost to CSSPPA (CFAF/kg) a/	691.40
Cost to Government (CFAF/kg)	590.90

a/ Cost to CSSPPA is given here because, although it is a government parastatal organization, its financial status has important impact on purchases of coffee and cocoa for farmers.

Source: IECCM

56. If present policies are continued, the projected accumulated CSSPPA deficit between 1988 and 1997 is CFAF 1,115 billion (or US$3.84 billion). The corresponding figure for the government deficit is CFAF 359 billion (US$1.24 billion). Thus, continuation of the present policies implies drainage of government revenues into the cocoa sector when diversification to coffee and other crops is desirable. From the figures in Table 11 it can be estimated that to balance the CSSPPA's cost with the export unit value, the producer price would have to be lowered from 400 CFAF/kg to 230.6 CFAF/kg. The producer price to balance the cost to the government would be 331.1 CFAF/kg. Alternatively, the currency would have to be devalued to 529.8 CFAF to one US dollar (by 32%) to balance the CSSPPA cost. The devaluation necessary to balance the government cost would be 13%.

B. Costs and Effects of Coffee Sector Policies

57. As discussed in previous sections, the Government of Côte d'Ivoire intends to use subsidy programs involving stumping and replanting to increase coffee production. The stumping program has been incorporated into the model. It is assumed that stumping increases yield on the average by 300 kg/ha. When exported, this incremental yield would earn US$720 or CFAF 208,800 per hectare in terms of 1988 prices. However, this program causes a negative cash flow for the CSSPPA and the government. Calculated from Table 10, one kg of coffee will bring on the average CFAF 65.4 to the CSSPPA and CFAF 165.4 to the government per year for the period 1989-2000. The corresponding figures for a hectare are CFAF 19,620 and CFAF 49,620. However, the current stumping program pays the farmer CFAF 60,000 per ha. Thus, this program will cause a net government

deficit of CFAF 34.6/kg for incremental coffee production. If the program succeeds in making growers stump 18,000 ha as assumed in the base run simulation, the accumulated stumped area will stabilize at 90,000 ha (assuming that after 5 years trees need stumping again), increasing production by 27,000 tons. The cost of the subsidy program would be CFAF 1.08 billion per year.

58. Under consideration is a subsidy program for replanting of coffee trees. Simulation results with 20,000 ha/year of replanting are also given in Table 12. Under this scenario, coffee production is higher by 28,000 tons by 1995 and by 56,000 tons by 2000 compared with the Base Run. The rather small differences compared with the Base Run result from the assumption that new plantings which would have taken place anyway would be replaced by 20,000 ha of replanting under the program. About 15,000 ha of new plantings were made in recent years. The program's net effect, therefore, is 5,000 ha of new plantings. Until there is research done on the replanting response to incentives, we can only make an estimate of the response to the subsidy.

59. The suggested replanting program seems to have some problems, including the following: (i) as in the case of the stumping program, this program provides subsidies only for replanting. The program does not generate improved husbandry as would an increase in the producer price. Thus the yield on replanted trees might be small; (ii) the program will incur substantial costs to the government. In the near future the government is projected to earn approximately CFAF 117.6/kg from coffee. If the replanting program succeeds in increasing yield per ha by 700 kg, the government will make CFAF 82,320/ha. If the cash subsidy amount is CFAF 200,000/ha (the proposed

sub·idy), the program will lead to a deficit of some CFAF 117,680/ha or a total of CFAF 2.35 billion per year; (iii) apart from the above costs, SATMACI staff and seedling nurseries would have to be increased. No estimates are made of these costs, but they could be substantial.

60. The results of a 10% increase in the real producer price for coffee is also shown in Table 12. This simulation does not include the stumping and replanting programs. Comparison of the results in Table 12 shows that the stumping program would be the most effective in terms of cost/benefit ratio and the producer price increase the least effective. Results in Table 12 should be interpreted with caution, however, as the effects of a producer price increase are most probably underestimated. As stated in Section II, if adequate price incentives are given for coffee, growers are likely to stump and replant without cash subsidies. Better organization of the extension services may add to this price response.

61. The results of the simulations show that Ivorian coffee production may decline rather sharply if current policies are continued. This decline would be due mainly to the pricing policy which favors cocoa over coffee.

Table 12: COSTS AND EFFECTS OF COFFEE POLICIES; 1988-2000

Year	Without any Subsidy Program and no Price Change	With Stumping of 18,000 ha/year at CFAF 60,000/ha		With Replanting of 20,000 ha/year at CFAF 20,000/ha (including 18,000 ha/year Stumping)		Producer Price Increase of 10%	
	Production	Production	Fiscal Cost	Production	Fiscal Cost	Production	Fiscal Cost
	---('000 T)---	-('000 T)-	(billion CFAF)	-('000 T)-	(billion CFAF)	--('000 T)--	(billion CFAF)
1988	233.00	239.00	1.08	239.00	4.00	239.00	9.01
1989	226.00	237.00	1.08	237.00	4.00	231.00	8.71
1990	218.00	234.00	1.08	235.00	4.00	222.00	8.37
1991	199.00	220.00	1.08	225.00	4.00	203.00	7.65
1992	184.00	211.00	1.08	222.00	4.00	189.00	7.13
1993	177.00	204.00	1.08	223.00	4.00	183.00	6.90
1994	170.00	197.00	1.08	221.00	4.00	178.00	6.71
1995	164.00	190.00	1.08	218.00	4.00	175.00	6.60
1996	159.00	186.00	1.08	218.00	4.00	173.00	6.52
1997	155.00	182.00	1.08	222.00	4.00	172.00	6.48
1998	151.00	177.00	1.08	224.00	4.00	170.00	6.41
1999	146.00	173.00	1.08	225.00	4.00	167.00	6.30
2000	141.00	167.00	1.08	223.00	4.00	164.00	6.18
TOTAL	2,322.00	2,615.00	14.01	2,932.00	52.00	2,466.00	92.97
Cost per kg of increase in production for 1988-2000 (CFAF/kg)			46.8		164.0		645.6

Source: IECCM.

C. Simulations on Recommended Changes in Coffee and Cocoa Producer Prices

62. The simulation results above show clearly that the continuation of present policies are likely to lead to huge government deficits arising from subsidization of the cocoa sector and a substantial decline in coffee production. Various solutions to these problems may be considered, i.e., devaluation of the currency, the provision of incentives for coffee growing (increasing prices and/or subsidies) and the reduction of the producer price for cocoa. Since devaluation is an unlikely option for the near term a simulation run was made on changes in the pricing policy.

63. As discussed in sub-section A above (see also Table 11), to eliminate the government deficit from cocoa, cocoa producer prices would have to be considerably reduced. This is politically difficult. The maximum reduction in cocoa producer prices likely to be possible in the near term is probably about 10%. As for coffee, the subsidy programs will be much more effective if producer prices are directly increased; this will provide incentives for farmers to grow coffee, which will give better results for the replanting program. To illustrate the impact of such effects, a simulation run was made under the following assumptions:

(a) From 1988 cocoa producer prices are reduced by 10% and coffee producer prices are increased by 10%.

(b) Stumping of coffee trees is carried out over 30,000 ha a year during the period 1988-2000.

(c) With improved price incentives, the replanting program is assumed to add 12,000 ha of coffee plantings during the period 1988-2000.

64. The results under the above assumptions are shown in Tables 13 and 14. Under this set of policies, coffee production is much higher than in the Base Run--38% more in 1995 and 72% more in 2000. Cocoa production is reduced by 4% in 1995 and by 9% in 2000 compared with the Base Run. However, even with a 10% reduction in the cocoa producer price, the cocoa sector is projected to involve large deficits for the CSSPPA and the government for several years.

65. To illustrate the trade-off between coffee and cocoa production, Table 15 summarizes some of the key statistics from Tables 9 and 13. Table 15 shows that CSSPPA and government balances and export revenues from the two commodities improve substantially under the recommended policies, although there may be some reduction in the gross revenue of growers.

Table 13: RESULTS OF RECOMMENDED POLICY RUN FOR COFFEE: 1988-2000

Year	Production	Cost to CSSPPA on c.i.f. Basis	World (c.i.f.) Price		Revenue From Export Tax	CSSPPA Balance	Net Government Balance	Export Revenue	
	-('000 T)-	--(CFAF/kg)--	(US$/kg)	(CFAF/kg)	(Billion CFAF)	(Billion CFAF)	(Billion CFAF)	(Million US$)	(Billion CFAF)
Coffee									
1988	249.5	745.6	250.0	725.0	24.9	-5.1	16.8	564.3	163.7
1989	250.8	745.6	250.0	725.0	25.0	-5.1	16.9	567.3	164.5
1990	252.7	745.6	254.0	736.6	25.2	-2.3	19.9	581.5	168.6
1991	247.0	745.6	258.0	748.2	24.6	0.6	22.2	577.9	167.6
1992	250.4	745.6	262.0	759.8	24.9	3.5	25.5	595.8	172.8
1993	256.1	745.6	266.0	771.4	25.5	6.5	29.1	619.5	179.7
1994	259.7	745.6	270.0	783.0	25.9	9.6	32.5	638.5	185.2
1995	262.6	745.6	271.0	785.9	26.2	10.5	33.6	648.3	188.0
1996	268.0	745.6	272.0	788.8	26.7	11.5	35.2	664.1	192.6
1997	276.0	745.6	273.0	791.7	27.5	12.6	37.1	686.9	199.2
1998	282.1	745.6	274.0	794.6	28.1	13.7	38.8	704.8	204.4
1999	286.1	745.6	275.0	797.5	28.5	14.7	40.2	717.7	208.1
2000	288.0	745.6	275.0	797.5	28.7	14.8	40.5	722.3	209.5

Source: IECCM.

Table 14: RESULTS OF RECOMMENDED POLICY RUN FOR COCOA: 1988-2000

Year	Production	Cost to CSSPPA on c.i.f. Basis	World c.i.f. Price		Revenue From Export Tax	CSSPPA Balance	Net Government Balance	Export Revenue	
	-('000 T)-	--(CFAF/kg)--	(US$/kg)	(CFAF/kg)	(Billion CFAF)	(Billion CFAF)	(Billion CFAF)	(Million US$)	(Billion CFAF)
Cocoa									
1988	634.3	651.4	181.4	525.9	63.7	-79.59	-15.84	989.1	286.9
1989	659.6	651.4	178.3	517.1	66.2	-88.43	-22.24	1,007.1	292.0
1990	683.0	651.4	180.9	524.6	68.6	-86.62	-17.98	1,061.8	307.9
1991	706.7	651.4	183.5	532.1	71.0	-84.28	-13.26	1,117.2	324.0
1992	727.4	651.4	186.4	540.6	73.1	-80.59	-7.48	1,171.2	339.6
1993	747.5	651.4	189.4	549.2	75.1	-76.36	-1.24	1,225.7	355.5
1994	763.7	651.4	192.8	559.1	76.7	-70.50	6.2	1,278.2	370.7
1995	770.3	651.4	197.3	572.0	77.4	-61.12	16.3	1,323.6	383.9
1996	776.6	651.4	201.8	585.1	78.0	-51.48	26.6	1,369.5	397.2
1997	779.5	651.4	206.9	599.9	78.3	-40.13	38.2	1,414.5	410.2
1998	783.1	651.4	211.9	614.5	78.7	-28.86	49.8	1,460.4	423.5
1999	781.8	651.4	217.5	630.8	78.6	-16.07	62.5	1,501.9	435.6
2000	781.3	651.4	223.1	646.9	78.5	-3.50	75.0	1,544.3	447.8

Source: IECCM.

Table 15: COMPARISON OF THE BASE RUN AND THE RECOMMENDED POLICY RUN: 1988-2000

Year	Growers' Revenue		CSSPPA Balance		Government Balance		Export Revenue	
	Base Run	RPR /a	Base Run	RPR	Base Run	RPR	Base Run	RPR
	(Billion CFAF)						(Million US$)	
1988	350.4	331.8	-107.08	-74.49	-18.96	0.9	1,543.2	1,553.5
1989	359.5	341.1	-117.41	-93.55	-27.01	-5.37	1,555.6	1,574.3
1990	368.4	350.7	-114.22	-88.87	-21.60	1.9	1,613.2	1,643.3
1991	373.4	356.8	-111.23	-83.64	-17.45	9.0	1,647.0	1,695.0
1992	379.0	365.7	-107.16	-77.06	-12.02	18.0	1,688.9	1,766.9
1993	385.7	375.3	-103.11	-69.81	-6.34	27.8	1,736.7	1,845.2
1994	391.3	382.6	-97.95	-60.88	0.2	38.7	1,783.0	1,916.7
1995	394.1	386.2	-90.94	-50.63	7.9	49.9	1,820.6	1,971.9
1996	398.0	390.7	-84.12	-40.01	15.6	61.7	1,863.9	2,033.6
1997	401.1	395.1	-75.53	-27.52	25.0	75.3	1,909.1	2,101.3
1998	404.7	398.9	-67.12	-15.16	34.3	88.6	1,956.2	2,165.2
1999	406.0	400.1	-56.65	-1.35	45.0	102.7	1,998.1	2,219.6
2000	407.3	400.7	-46.76	11.3	55.2	115.5	2,037.7	2,266.6

/a Recommends Policy Run.

Source: IECCM, Côte d'Ivoire Coffee and Cocoa Models.

ANNEX A

Effects of Ivorian Production on World Prices

66. As Ivorian coffee export quantities are not expected to exceed 5% of total world coffee exports, it was assumed that Côte d'Ivoire is a "price taker" in this market. However, such an assumption is not realistic for cocoa as Côte d'Ivoire's world export share is about 30%. In the model used here world cocoa prices are based on those projected by the World Bank. These projected prices are based on the World Bank's projection of Ivorian production. Thus, if Ivorian policies are changed and different Ivorian production levels from those projected follow, the projected world price levels should also change. Evaluation of all the simultaneous changes in world cocoa prices, world stock levels and production by other producing countries resulting from changes in Ivorian cocoa production would require a full-fledged world model. Incorporation of simulation and results from such a large model would have made this study much more extensive. Therefore, a simpler relationship between Ivorian production level and world prices has been incorporated.

67. Inputs required for this part of the model are the World Bank's projected Ivorian production, Côte d'Ivoire's world market share and the Bank's projected world prices. Given these inputs and assuming the world price elasticity of demand to be -0.3 and the price elasticity of supply by the rest-of-world to be 0.4 (this should be lower in the short-run and higher in the long-run), world prices as a function of Ivorian production can be defined as:

$$WP = WP^b \cdot \{1-\{100 \cdot ICMS \cdot \{ICPD - ICPD^b\}/ICPD^b\}/\{E_d + \{1-ICMS\}\ E_s\}$$

Where:

- WP = World cocoa prices
- WP^b = World cocoa prices projected by the Bank consistent with $ICPD^b$
- $ICMS$ = Ivorian world market share of cocoa production
- $ICPD$ = Ivorian cocoa production from the model
- $ICPD^b$ = Ivorian cocoa production projected by the Bank
- E_d = World price elasticity of demand
- E_s = Price elasticity of supply by other producing countries

68. In the above equation, the percentage difference between ICPD and $ICPD^b$ is first calculated. Multiplying this value by the Ivorian world market share gives the percentage difference between ICPD and $ICPD^b$ in world total production. The impact of this percentage difference in world production on world price can be derived by dividing it by the sum of the world price elasticity of demand and the price elasticity of supply by other producing countries.

69. Substituting 0.3 for ICMS, 0.3 for E_d and 0.6 for E_s, the equation above shows that a 1% increase in the Ivorian production reduces world prices by 0.41%. This implies that the last 1% of exports increases export revenue by 0.59% (i.e., 1.0 - (1.01 * 0.9959)).

Assumptions Made for Construction of Vintage Capital Matrices

(a) The yield curve assumed is based on data in the "Agricultural Sector Review" with some modification prompted by discussions with SATMACI extension officers and IRCC agronomists.

Years After Planting	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15-30
Traditional Coffee	0	0	0	100	250	350	350	300	210	210	210	210	210	210	210
Improved Coffee	0	0	100	350	700	900	600	400	500	750	600	500	400	450	450

Years After Planting	1	2	3	4	5	6	7	8	9-20	21-30	Over 30
Traditional Cocoa	0	0	0	0	150	250	330	400	450	300	200
Hybrid Cocoa	0	0	150	200	300	500	600	700	750	650	550

(b) The death rates of trees refers to the percentage of trees that die over time. This information was obtained from SATMACI extension officers and IRCC agronomists.

Years After Planting	0-10	11-20	21-30	31-40	Over 40
	(% p.a.)				
Traditional coffee	0	1.4	2.6	3.6	4.0
Improved coffee	0	2.0	6.6	12.9	-
Traditional cocoa	0	1.0	3.0	7.0	-
Hybrid Cocoa	0	1.0	3.0	7.0	-

(c) Because new plantings data are available only from 1960 for coffee and 1969 for cocoa, the vintage capital matrices calculate the production potential of trees planted since that time. Therefore, assumptions must be made about the production potential of trees planted in prior years. The production potential of old trees can be estimated by substracting the production potential of new trees from total production. However, this difference suffers from fluctuations caused by weather and other factors. To eliminate the fluctuations, an exponential curve was fitted. This calculation assumes a constant percentage decline in the production capacity of old trees with time. The rate of decline so estimated is then applied for the period over which data are available. For future periods, higher rates of decline are assumed as the production capacity of old trees suffers both from tree death and from yield decline.

Assumed rates of decline in production capacities of old trees are as follows:

Years	Up to 1973	1973-84	1985-1994	1995-2000
	(% p.a.)			
Cocoa	0 a/	3.8	8.0	20.0

Years	Up to 1970	1971-1980	1981-1990	1990-2000
	(% p.a.)			
Coffee	0 a/	7.0	8.0	35.0

a/ The production capacity of old trees is defined as the difference between actual production and the production potential of new trees.

(d) In 1983 bush fires killed large numbers of coffee and cocoa trees. According to the agricultural surveys, about 8% of the standing trees died. This death rate was applied to trees of all ages.

(e) the effects of stumping (recepage) are taken into account in the model. It is assumed that each hectare of stumped trees adds 300 kg to total coffee production capacity.

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